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Education on Autopilot:
Automation in the Classroom

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Report

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Master of Arts

The University of Texas at Austin

August 2019

Abstract

Education on Autopilot:
Automation in the Classroom

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The University of Texas at Austin, 2019

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The purpose of this research is to examine the ethical implications of automating education within a classroom. Automation is widespread throughout the workforce and expected to grow as technology continues to proliferate. From manufacturing cars to piloting planes, we have already seen automated systems take what was previously a human job. However, one job sector understudied for its potential use of automation is education. With the cost and access to education becoming a continued issue both domestically and internationally, corporations like Facebook, IBM, and Pearson have already begun experimenting with automated, computerized educators. To study the ethical implications of such automation, we will build a framework for the moral responsibilities of a teacher, examine the feasibility of automated systems meeting these guidelines, discuss the results of this analysis, and examine future implications. This paper will ultimately find that teacher's jobs are secure as education is a sector that, due to its complex social interactional requirements, is nearly impossible to fully automate.

However, automation can play a vital role in pairing down the more menial tasks of an educator, therefore still having the ability to revolutionize the field.

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INTRODUCTION

Like most students at her school, seventeen-year-old Kelly Hernandez spent most of her days sitting in front of a computer screen. Her school curriculum consisted of readings, videos, and audio recordings all preassigned and presented to her in a single terminal. She did not interact much with the other students, that is until they all decided they had had enough. “It’s severely damaged our education, and that’s why we walked out in protest”, Hernandez said, right after she and all her classmates walked out of the Secondary School for Journalism in New York City (Strauss, 2018, p. 2). They were all part of a new curriculum called, Summit Learning, an early attempt at automating education created by the tech giant Facebook. Although compounded with the student protest, this appears to be merely a one-off failed experiment, there exists a strong possibility that automation needs to be included in the future of education (Houser, 2018).

In 2015, UNESCO or the United Nations Educational, Scientific, and Cultural Organization, set the 2030 Agenda for Sustainable Development which included global access to a quality education (Houser, 2018). However, according to its own report, in order to meet the specific standard of, “instruction from qualified teachers,” 68.8 million new teachers would have to enter the workforce to cover our current shortage and those expected to retire in the next thirteen years (UNESCO, 2016). That task alone is nearly impossible without automation. So as a result, the Bill and Melinda Gates Foundation offered grants to 14 higher education institutions to research, “adaptive learning technology” or machines that could automate an education and adapt in some way to each student. At the conclusion, they found the technology was mostly unsuccessful (Schrager & Wang, 2017). However, as 2030 is approaching and we still have an

education target to meet, this paper will examine the progress we have made since by exploring how well our current technological capabilities can build a supportive classroom. To do this, it will create a framework definition for the responsibilities of an educator, examine case studies into automation programs developed in educational spaces, develop a discussion of how well our technology can meet those goals, and explore the implications of automating education into the future.

FRAMEWORK

This section aims to make clear the fundamental roles and responsibilities of teaching. Public education has historically been a minefield of mismeasured policies, inequitable classroom spaces, and unfair systems of discipline (Boyes-Watson, Riestenberg, & Pranis, 2015). In these spaces, vulnerable and marginalized populations can continually become more vulnerable and more marginalized through systems of social reproduction which continue to reinforce oppression. In other words, students who are systematically distanced from their own education, whose agency in the classroom is limited and are made to feel like they do not belong are less likely to succeed due to these factors that very much work along the boundaries of identity. Students of color, in particular, are likely to find themselves in unequal footing with their peers when examining a standard classroom (Ladson-Billings, 1995). This paper will detail, that through systems of oppression like white dominated pedagogies and Zero Tolerance discipline policies disproportionately targeting students of color, large populations of our educational system receive a comparatively disadvantaged education. However, rather than simply utilizing status quo representations of what school has historically been for students, this paper aims to be more critical. In this way, it will take a more idealistic approach to focus on what teachers should be in the classroom, building a framework for the teaching ideal. We can only seek to remedy the historic harms of education by undoing these systems of oppression and focusing on how to give every student a fair chance (Freire, 1970). After all, if UNESCO's aim was to get, "instruction from qualified teachers" we need to remember that since students are the determinant factor in measuring the quality of their own education, we must ensure this framework encompasses all students, not simply a privileged few (UNESCO, 2016). Therefore,

this section will examine the definitions of "instruction from qualified teachers" through curriculum, classroom set-up, and discipline.

Curriculum

First, in status quo classrooms, students are not valued for their culture (Valencia, 1997). The pieces of knowledge and skills the upper and middle class traditionally carry into the classroom are disproportionately favored over others. As far as curriculum goes, this automatically assigns students the labels of "insiders" or "outsiders" to their own classroom, as the dominant narrative of the subject prefers one kind of student to another (Yosso, 2005). And with those labels also comes a specific mindset: an assumption that some students are, "deficit" (Valencia, 1997). Preferencing some students over others in education can be incredibly harmful as, for the student, it creates a vast disconnect. While at home their cultural knowledge may be celebrated and cultivated, that often stops as soon as they enter the school campus (Moll, Amanti, Neff, & Gonzalez, 1992). Scholars contend there are only two pathways to earn membership into that dominant group: from one's family or through formal schooling (Yosso, 2005). And when one's family does not fit the traditional narrative supported by dominant cultural capital, students are expected to assimilate at school. As one author compares, for students walking in knowing their teachers carry a deficit mindset toward them, it can feel much more like a prison than a school (Valenzuela, 1999).

Second, using the framework of Critical Race Theory, we can come up with a better lens to examine the treatment of students. Critical Race Theory stems from a critique of legal studies, arguing the standard discussions of law typically ignore the moral and ethical underpinnings of

how they reinforce systems of oppression. Initially, many of the ideas produced from Critical Race Theory offered a challenge to the unrealized promises of the Civil Rights Movement (Yosso, 2005). And, while the Black/White binary perpetuated by Critical Race Theory still pervades popular discourses in the United States, later scholars formed stems of intersectionality in an attempt to remedy this discursive dichotomy, speaking to how more diverse notions of race, gender, and class alter the experience of an individual. And it's these very differences we often mistake as deficits, failing to acknowledge what produces them and how they can contribute to the larger education of a student. Culture produces what are called, "Funds of Knowledge" or the accumulated bodies of information created within households to navigate difficult social, political, or economic circumstances (Moll, Amanti, Neff, & Gonzalez, 1992, p. 133). These attributes can range broadly across fields, including farming, medicine, engineering, art, and so many more (Moll, Amanti, Neff, & Gonzalez, 1992). And by instructing the student as if they have nothing to contribute to their own education, we miss out on our students and ourselves becoming more aware of the world around us. And to undo this, we need to stop imagining difference as deficit and start recognizing it as an attribute.

Third, educators have a responsibility to make their student's culture relevant in the classroom. Oftentimes, the failures of a particular student are attributed to problems at the individual level. We believe the student fails due to a unique deficit of the student, not the instruction they were given. But instead, we need to examine the possible failures of a student starting from the practitioner standpoint (Ladson-Billings, 1995). A quality education about the world around us begins with conceptions of the self. Insofar as students understand themselves and their position in the world, they are more able to better that position and fight against

oppressive forces. Liberation from oppression is rooted in self-examination, agency, and the knowledge required to obtain those things. As Freire (1970) writes, “Freedom is acquired by conquest, not by gift” (p. 47). And for many students, the pressure of assimilating into the dominant culture prevents this from happening. For some, their education becomes rooted in the difficulty of negotiating between academic success and cultural competency (Ladson-Billings, 1995). However, the role of the instructor should be to mine the gap between culture and curriculum content for students. Culturally Relevant Pedagogy posits that instructors should focus less on putting knowledge in students and focus more on pulling it out, treating them and their culture as valuable attributes to their education (Ladson-Billings, 1995). This starts with knowing and acknowledging your student's cultures before building them into lessons, allowing your students not just to see themselves in your teaching, but to be part of the teaching process (Macedo & Bartolomé, 1999).

Additionally, the Whole Student Approach can also be accomplished through the instructor taking a less dominant role in the classroom. Most direct-teach, banking models of pedagogy, rely on the teacher dominating the space while students remain comparatively less agentic. This domination is carried out, "[...] through the deployment of teacher-centered and control-oriented instructional practices" (Fine, 2018, p. 107). Students under this kind of leadership can often think less of themselves in comparison, imagining they are less capable, less intelligent, and less self-determined than their instructors (Boyes-Watson, Riestenberg, & Pranis, 2015). An alternative to this is taking the Whole Student Approach done through, "eschew[ing] pedagogical authoritarianism and embrac[ing] practices that are relational, learner-centered, and anti-oppressive" (Fine, 2018, p. 123). Educating the Whole Student means evaluating not only

their content-specific knowledge and your ability to teach that, but to access larger dimensions of their humanity. Social and Emotional learning are key aspects of this approach, as we can safely expect that our students will use more than just content knowledge out in the real world (Boyes-Watson, Riestenberg, & Pranis, 2015). And this style of learning does not even have to deviate significantly from a standard curriculum, just be implemented within it. As Scholar Nel Noddings (2010) suggests, "Students can develop reading, writing, speaking, and mathematical skills as they plan and stage dramatic performances, design classroom murals, compose a school paper and participate in establishing classroom rules" (p. 7). All of this is easily achievable and significant enough to be part of the framework of quality instruction.

Next, representation is also a fundamental aspect of quality instruction. It should be no surprise that the stories, histories, and writings we study most are predominantly white, male, straight, upper class, and Christian. Indeed, a recent study of the Texas Social Studies TEKS found that 67% of mandatory content excluded communities of color from the discussion (Heilig, Brown, & Brown, 2012). And this can have a lasting effect, as one teacher notes, "[...] the fact that some kids began to view so-called, "American" culture as superior to their own was really no surprise. It was being offered up -consciously or not- as what was normal, average, or even ideal" (Michie, 2000, p. 81). Communities such as Native Americans and Asian Americans are perhaps the most absent, leaving little to no opportunities for those communities to see themselves in the presented curriculum (Heilig, Brown, & Brown, 2012). So if the goal is to have students be an integral part of their education, representing your students in the taught content becomes a fundamental goal. And that means adapting and changing one's content to a particular

set of students. The 'one size fits all' approach in education cannot meet the needs of students to be part of their own learning, as the curriculum must reflect them too.

However, we should also bear in mind that representation does not just mean adding people into the curriculum, it means doing those stories justice. Take for example the story of Rosa Parks, ubiquitous in both American culture and the history classroom. Traditionally, this is told as the story of a tired, angry seamstress who boarded the bus one day, got told to move, refused, was arrested, and subsequently started the Montgomery Bus Boycotts (Kohl, 1994). This story usually describes that, totally on her own, Rosa Parks inspired one of the most extensive acts of resistance of the Civil Rights era. However, what's usually left out are all the other thousands of people who participated in those boycotts, how significance they were in the success of the movement, and that Rosa Parks was a prominent member of the NAACP as well as being a seamstress (Kohl, 1994). This story is not told in history classes, despite the fact that "[This story] of collective decision making, willed risk, and coordinated action is more dramatic than the story of an angry individual who sparked a demonstration" (Kohl, 1994, p. 171). Indeed, although we can certainly tell stories in classes that meet the eye as representative of our students, oftentimes they are done tacitly and with ill consideration to the true story or it's complicated meaning. As the previously cited scholars describe, "[...] our textual analysis of the TEKS is a cautionary tale for systemic reformers, as it highlights how race, culture, and difference can be centralized and obscured in very nuanced ways—an illusion of inclusion" (Heilig, Brown, & Brown, 2012, p. 421). Inclusion and representation must, therefore, be thoroughly thought through before being presented, taking into consideration just what our standard information pathways may have lost along the way.

Classroom Environment

Initially, democratic classrooms assume collective participation by an informed, involved body of students. Dahl and Shapiro's (2015) framework for deliberative democracy is comprised of effective participation, voting equality, enlightened understanding, control of the agenda, and the inclusion of all participants. These help to build conclusions surrounding how individuals within democratic classrooms can share collective responsibility for dictating large aspects of their own education. Agency and individualism are both values inherent within a system like this, but so too are community building and mutual respect. That is why group projects and activities can be useful, as, "Teachers build community among their groups by encouraging them to create names that provide them with collective identities" (Mirra & Morrell, 2011, p. 416). And it's these collective identities that can also help in shaping democratic action, building coalitions of like-minds to generate change. As Guinier and Torres (2003) explain, identity markers like race can heavily influence democratic discourses. Collective action is, therefore, necessary to leverage against the asymmetry of individual power and can act as a vital tool for marginalized individuals to ensure their own protection (Guinier & Torres, 2003). And, if power within the classroom is inherently asymmetric between students, the presence of a collective free to communicate and interact with one another is vital to an equitable democratic classroom.

Also important are the kinds of citizens teachers should invite students to be and become. Teachers should not simply tell students what or how to think but showcase to them pathways of knowledge (Freire, 1970). Their education, therefore, becomes a nuanced interconnection of moralistic arguments, challenging students to think not just about what is, but what should be. Westheimer and Kahne (2004) argue the apex of citizenship is a "Justice-Oriented Citizen" or

citizens who can, "[...] analyze and understand the interplay of social, economic, and political forces" (p. 242). Banks (2008) presents a similar concept of optimal, "Transformative Citizenship" defined as, "[...] a citizen who takes action to actualize values and moral principles beyond those of conventional authority; a postconventional citizen" (p. 137). The definitions seem to differ slightly on whether understanding or action should be valued more, but both agree an education requires complexity. They offer students should not just be taught how to vote, but the values inherent in every level of civic action. Teaching simply through the normative lens on what systems of capitalism and democracy are is not enough. Along with what makes America great, these classrooms should also explore its flaws and be critical its actions (Abowitz & Harnish, 2006).

This is not easy, but that is kind of the point. Students and their opinions should be challenged in the context of the classroom, not necessarily directly by the instructor, by implicitly by the content given. Abowitz and Harnish (2006) argue, "Social studies teachers have a duty to help students explore a variety of positions in a thorough, fair-minded manner" (664). And this is done through challenging the social, economic, and political systems we are a part of every day, as teachers work to produce the best environment to transform student mindset (Abowitz & Harnish, 2006). A good example of this kind of environment would be that created by Youth Participatory Action Research, or YPAR (Rubin, El-Haj, Graham, & Clay, 2016). It is a project-based learning activity that invites students to research a pertinent issue of their choice in their community. When preservice teachers attempted running the project, they often, "[...] wrestled with the difficult and essential balance between guidance and freedom" (Rubin, El-Haj, Graham, & Clay, 2016, p. 427). However, this is simply part of the activity. Teachers are there to

help students, but must also let them embrace their own freedom and self-determination in examining how their lives are impacted by inequality (Rubin, El-Haj, Graham, & Clay, 2016). YPAR acts as an example of the tenuous, albeit necessary, balance in allowing students to educate themselves.

If the goal of a democratic classroom is valuing individual agency, collective interest, and inclusive participation, those are all objectives this analysis is looking for technology to fulfill. To make clear the parameters of a democratic classroom, Apple and Beane (1995) sum it up best, stating, "A democratic curriculum invites young people to shed the passive role of knowledge consumer and assume the active role of, “mean makers”" (p. 17). And to invite students to become, “mean makers” a curriculum must provide a few things. The first is that teachers ensure students are respected as individuals but are also encouraged to participate within the collective classroom. And since marginalized students may one day rely on collective action to give the best assurance of their protection, allowing students to interact with one another is critical to their development (Guinier & Torres, 2003). Additionally, challenging students within the classroom space about their views and opinions is vital to an education. Students cannot just be told, they must be active agents of their own learning (Freire, 1970). For technologies to properly create the space of a democratic classroom, they must probe students answers and dig deep on their perspectives, challenging them to think more critically about the world in which they live. Through code and screen, they must provide students with a well-rounded and critical education they have some say in dictating, not simply facts and figures.

Discipline

Additionally, for our education system to properly be automated, so too would our systems of discipline. And unfortunately, we also see failures of school punishment within our schooling system. Our education system has become obsessed with hyper-punitive measures which only serve to create the School to Prison Pipeline. Although the United States certainly is not new to punitive measures against students, Zero Tolerance Policies were introduced as part of a countrywide effort to reduce school violence, especially as it involves firearms. The 1995 Gun-Free Schools Act requires that schools receiving federal funds adopt policies to automatically expel students for bringing firearms to school (Boyes-Watson, Riestenberg, & Pranis, 2015). Soon after, the policies expanded. The Gun-Free Schools Act led state legislatures and school districts down a path to craft punitive measures for a myriad of offenses intended specifically to remove accused students from the classroom. In Texas alone between 2000-2002, 54% of students experienced in-school suspension and 31% received out of school suspension. However, even with all this said, only three percent of student punishments were based in state mandates (Fabelo et. al, 2011). And with 75% of schools nationally operating Zero Tolerance policies, there exists a strong correlation between these policies and the School to Prison Pipeline. Students who are sent out of the classroom often end up becoming more distanced from school and later getting arrested for a separate offense (Smith, 2015). And when our school system is continually pushing students into a life of crime, one is forced to wonder if it is really a system built for them.

Community is clearly an important element to the success of one's education, as "[...] there are three pillars of human need: autonomy, order, and relatedness. When these needs are

not met, students may go to great extremes to meet those needs" (Anfara, Evans, & Lester, 2013). With relatedness being so core and central to the needs of our students, the last phrase of, "great extremes" should bear particular significance. Youth suicide has seen a steady rise in the United States so much so, it is now the second leading cause of death for people aged 10-24 (The National Institute of Mental Health, 2019). And although this likely has to do with a myriad of variables, feelings of isolation and separateness are part of the overall consequences of a lack of community building. Often, we consider the solutions in education policy to be just that: solutions. When Zero-Tolerance policies were put into effect, it's hard to imagine we carefully considered how they might affect a student's mental health. However, often are administrators "[...] failing to consider the possible harm caused by the institutional practices imposed on students" (Anfara, Evans, & Lester, 2013, p. 60). Within the Juvenile Justice System, the need for community is evident. Research has shown, "[...] that low-level juvenile offenders are less likely to reoffend if, rather than being incarcerated, they are allowed to remain within their communities and are given access to community-based programs" (Tsui, 2014, p. 604). Many of our punishments come directly into conflict with the goals of a given educational institution: to create a broad sense of collective identity. When individuals are separated from the community, that collective identity is exactly what is lost.

Therefore, with discipline standards being part of a schooling system, upholding Restorative Practices should be part of a quality education. Restorative Practices act as a less punitive alternative to Zero Tolerance Policies, adhering to a Whole Student Approach and community engagement (Noddings, 2010). Politicians, administrators, and even teachers can be quite hawkish in their approach to school punishment. But separate from being harmful, this is

not even necessary. Although school punishment is often framed as a huge, growing problem in education, school violence is only one fourth as prevalent today as it was in 1992, probably despite Zero-Tolerance (Smith, 2015). Additionally, although the cost is one of the most discussed reasons for not adopting Restorative Practices into education, they could end up being more affordable than our punitive measures. In the Juvenile Justice System for example, "[...] a 2005 study focused on Ohio compared the costs between community programs and incarceration found that the costs of the former were much lower" (Tsui, 2014, p. 644). And overall, the solutions are apparent. For example, after adopting Restorative Practices as the theory behind school punishment, Eastpoint Community School experienced a 45% decline in suspensions and a 30% increase in graduations (Evans & Vaandering, 2016).

Finally, from a practitioner standpoint, continually instilling the feeling of belonging is paramount. One of the biggest issues involving our current school punishment system is that we take the students who require the most attention and regressively give them less. With every punishment or infraction, every suspension or expulsion, we are further ensuring they feel like they do not belong in education. And insofar as they do not feel like they belong here, they will find somewhere where they do, potentially somewhere outside the law (Boyes-Watson, Riestenberg, & Pranis, 2015). And through in school suspension, the proper solution can be to keep "punishments" within the confines of the school. Even if teachers demand a student be removed from a classroom space, at least this gives students a space to be told, "you belong here". And given the inherent structures of Restorative Practices relative to one's autonomy, agency, and actualization of community, this practice can be vitally important to changing the narrative of school youth. School should not have to be a place of belonging or not belonging. It

should be an environment open and welcome to its students where you are defined by the person you are becoming, not the mistakes you have made along the way.

ANALYSIS OF CURRENT AUTOMATION CAPABILITIES

The salient aim of most automated learning is a term called, “Personalized Learning” (Kamenetz, Feinberg, & Mason, 2018, p. 1). It stems from a recognized need to individualize a student’s education as an instructor evaluates who that student is and what is most useful for them. Although Personalized Learning does not have a standard definition, Journalist Anya Kamenetz (2018) splits it into two categories:

> 1. The use of software to allow each student to proceed through a predetermined body of knowledge, most often math, at his or her own pace.
> 2. A whole new way of doing school, not necessarily focused on technology, where students set their own goals. They work both independently and together on projects that match their interests, while adults facilitate and invest in getting to know each student one-on-one, both their strengths and their challenges (p. 2).

Although most of our discourse will rely on the first definition, the second is sometimes a byproduct. Teacher’s aim to automate broad aspects of the classroom in an effort to meet with students one-on-one more frequently, better assessing and understanding their needs as individuals. For example, automating lectures or activity content through software would allow class time to be spent in meetings talking to students about their progress in the course (Kamenetz, Feinberg, & Mason, 2018). Before the meeting, the teacher would likely be able to access information regarding the students progress through the software on an incredibly detail-oriented level, far more than they might be able to discern through manually graded assignments.

However, Columbia University Libraries emerging technologies expert Jade Davis warns, “[...] teachers are learners in the space, too, but the software is not" (Kamenetz, Feinberg, & Mason, 2018, p. 4). It’s true, automated technology also leaves open the possibility of stagnating student success rather than scaffolding it. When student’s most accessed interface can reach only the limit of what coders knew about education before that class started, the burden of truly individualizing student needs still falls on the teacher. These next sections will, therefore, examine case studies of how current or emerging applications of this technology have suited student learning, exploring the strengths and shortfalls of each in truly upholding individual agency, collective interest, inclusive participation, and how they might handle a disciplinary process.

Summit Learning Platform (Facebook)

Facebook’s “Summit Learning Platform” hopes to replace many of the roles of the instructor in a classroom. The program, which now operates in over 380 schools across the United States, has students sitting through classes at the computer screen almost constantly. It was initially created in a joint project between eleven charter schools in California and Washington collectively called “Summit Public Schools” (Strauss, 2018, p. 2). Facebook, through the Chan Zuckerberg Initiative, partnered with these schools and created the software students use day in, day out. The day of Kelly Hernandez, the aforementioned student at the Secondary School of Journalism, is typical with this kind of software (Strauss, 2018). Student’s assignments, grading, lecture content, and progress is all given and tracked through the program. The only exceptions are “mentoring sessions” they have with teachers one-on-one to fit the

second model of Personalized Learning (Kamenetz, Feinberg, & Mason, 2018, p. 3). Aside from mentoring sessions, lunch, and scattered breaks, students stare at a screen to get their education. The platform also relies on the "Self Directed Learning Cycle" which includes, "Goal Setting, Planning, Learning, Showing, and Reflecting" ("Self-Direction," n.d.). And although this seems to displace the teacher, according to their website, "Teachers are the backbone of Summit Learning", "Lead collaborative, hands-on projects", and "Change the lives of students every day" ("What is Summit Learning?," n.d.). Overall, the program boasts, "greater student engagement, increased attendance, better behavior" (Kamenetz, Feinberg, & Mason, 2018, p. 5). Summit Learning is the kind of project which aims to transform the idea of equity in education, giving everyone the tailored education, they need to be successful.

However, not all is what meets the eye on Summit Learning, and the previously mentioned student walk-out certainly holds legitimacy. The program boasts high marks, with promises of somewhat miraculously solving for the job of teachers stretched thin. And it's acceptance throughout the country certainly speaks to its accessibility as a free platform. But it has drawn protest throughout the country, including in Connecticut, Ohio, Kentucky, Indiana, Idaho, and New York City (Kamenetz, Feinberg, & Mason, 2018). For Cheshire, Connecticut, Mark Zuckerberg's hometown, the project only lasted a year. The backlash from teachers and parents collectively ended the program and drove it out of town (Leskin, 2018). But it was the New York school which perhaps had the most extensive response. Students at the Secondary School of Journalism staged a walkout along with writing a letter to Mark Zuckerberg personally, outlining their problems with the curriculum.

The frustrations of the New York students can mainly be split into two categories: the

quality of their education and privacy concerns. Initially, the letter details, “Not all students would receive computers, the assignments are boring, and it’s too easy to pass and even cheat on the assessments. Students feel as if they are not learning anything” (Strauss, 2018, p. 3). Indeed, teachers have often observed disconnected students who Google answers to quizzes and continually become frustrated with a philosophy of, “learn at your own pace” which can easily stagnate students in seeing the same lesson over and over again (Kamenetz, Feinberg, & Mason, 2018, p. 2). A website operated by parents from eight different states called, “We the Parents” are trying to push back against the curriculum, saying it’s simply bad educational practice and puts the teacher in the role of “facilitator” (Leskin, 2018, p. 3). But what's even more alarming are the student’s privacy concerns. The student letter specifies:

> Summit is collecting our names, student ID numbers, email addresses, our attendance, disability, suspension and expulsion records, our race, gender, ethnicity and socio-economic status, our date of birth, teacher observations of our behavior, our grade promotion or retention status, our test scores and grades, our college admissions, our homework, and our extracurricular activities. Summit also says on its website that they plan to track us after graduation through college and beyond (Strauss, 2018, p. 4).

The students concerns showcase a lack of trust and instructor involvement, a general belief that the structure serves to undermine their agency rather than uphold it. The privacy concerns themselves also bring on a note of nervousness surrounding surveillance, speculating

Summit Learning, and subsequently, Facebook might actually have malicious interests at heart (Strauss, 2018). In total, although the Summit Learning Platform operates nationwide, it's clear that it is falling short on its ambitious promises, leaving students to suffer the consequences.

Watson Teaching Assistant (IBM)

In the Spring of 2016, Georgia Tech got a new kind of teaching assistant (or TA), and for good reason. Dr. Ashok Goel teaches one of their most popular online Computer Science classes for three hundred incoming students at a time. But the workload can be ludicrous. Dr. Goel answers roughly 10,000 questions a semester over email, usually the same ones over and over again (McFarland, 2016). And, although he already had eight TA's, they were also struggling to meet the demands of nervous nineteen-year-olds struggling through a rigorous curriculum. Then, Dr. Goel had an idea: to automate the process of answering student questions (Schrager & Wang, 2017). Goel scoured textbooks and news articles to find the right technology before he stumbled across a video of IBM's Watson computer winning Jeopardy, a game in question and answer format. IBM agreed to join in on the project and he began coding the machine. He fed the system the thousands of questions and answers from the semester prior, building a dataset that included nearly all of his and his TA's effort. At first, the project was a disaster, and Watson was found to cling to specific words within questions rather than acknowledging the specific information being sought after. So, Goel encoded additional layers of decision making into the system until he was satisfied. TA Jill Watson would not answer questions unless they had 97% accuracy (McFarland, 2016). And just to test how successful the experiment was, Dr. Goel threw in another level of challenge: the students would not be told the TA was not, in fact, a human.

The students were stunned when they found out. “Jill Watson is the best damn teaching assistant you could ever want”, some students raved. They described her as someone who answered emails thoughtfully, quickly, and was endlessly patient. Some even wanted to nominate her for, “TA of the Year” before finding out she was simply a computer program (Schrager & Wang, 2017, p. 5). But even this machine has its limits. Watson could answer questions when asked, but not build curriculums or engage in real dialogue with students. Had Dr. Goel’s course been in-person instead of online, the trick would have been much less convincing. Additionally, not all questions could be answered by the system. Watson would often confront students who asked personal questions that dealt with real issues and raw emotion, which then had to be forwarded to a human TA (McFarland, 2016). So even the best TAs have their limits, especially ones built by code.

However, the experiment is a great leap forward and opens the door to even more ambitious projects. The textbook manufacturer Pearson has been making “digital textbooks” for years that take a more dynamic approach to education through a combination of readings, audio recordings, and videos. However, they have partnered with IBM’s Watson to take it a step further: the development of a digital tutor. Similar to Goel’s, the program will be able to answer questions for a student, but also ask questions, quiz them, and even help direct a slightly correct answer into a more fully correct one. The Pearson/IBM partnership aims to supplement not just the role of teachers, but all levels of education from advisers to counselors, to administrators on (Schrager & Wang, 2017).

Khan Academy

“Personalized Learning” technology has also become fairly ubiquitous across education. Khan Academy is probably one of the more obvious examples. What started as a tool intended to provide Salman Khan's cousin tutoring from a distance turned into a global phenomenon with 17 million users. Their mission is to provide a "[...] free world class education for anyone, anywhere [...]" and this is typically accomplished through lecture videos (Pani, 2019, p. 1). Although their primary focus is reading and mathematics, the organization has branched out into every content area one can imagine for K-12 education, with over 6,000 videos just for the subject of Computer Science (Martin, 2019). Khan Academy boasts a staff of over 150 educators making content for the website and has begun branching out internationally, with their courses being translated into, "[...] more than 36 languages in addition to the Spanish, French, and Brazilian Portuguese versions of our site" ("About Khan Academy," 2019). Overall, Khan Academy boasts an impressive collection of content and, as a 501(c)(3) non-profit, all of it is freely accessible. With an account, you can access all of its various levels and areas of content as long as you have access to the internet. Khan Academy offers perhaps the best vision of automated education into the future: an open platform with advanced accessibility in mind which offers diverse, wide ranging content to nearly every student interested in seeing it.

Khan Academy uses a similar phrase to other platforms of automated education: personalized learning. The platform repeats the ongoing risk of students getting "left behind" in the classroom and advocates for a shift against the, "fixed lock-step model to a personalized, mastery-based instruction and practice" (Pani, 2019, p. 3). Sal Khan explains, “It's about every student getting to remediate if necessary, or accelerate if they can” (Kamenetz, Feinberg, &

Mason, 2018, p. 4). As a supplemental tool, the content can provide an additional lecture outside of class for struggling students or simply provide material to pull from in class. And it accomplishes this in a way that goes beyond lecture videos. Similar to Summit Learning, Khan Academy offers a host of resources from videos, to practice activities, to tests you can repeat over and over again. It's main mission is to ensure learning is directed by students at the pace they desire. This can often entail skipping more detail-oriented lessons insofar as one grasps the big picture concepts or simply rewatching lessons if a concept is misunderstood. In total, the platform self-reports that ninety percent of students see their grades improve from using the service ("Khan Academy," 2019). And with results that great, Khan Academy could very well pose a threat to the future of the teaching profession.

However, replacing teachers is far from the goal of the organization. While Khan Academy's most salient mission is to provide education to students, another goal of theirs is to empower teachers. In 2017, they unveiled a new tool called, "Teacher Aid" which allows teachers to not only track their students' progress through Khan Academy content, but build supplemental content within the platform to help better match their specific content area. It also includes 60,000 Common-Core aligned lessons to aid teachers in building and crafting lessons. With these tools combined, Khan Academy advertises that teachers can use the service to help decide which lessons to teach the next day based on their students viewable progress with the assignments from the night before (Johnson, 2018). Additionally, when asked specifically if he thought the platform posed a risk to the future career of teaching, Sal Khan seemed sure of his answer. While he said that maybe one percent of the profession could become automated, the remaining ninety-nine percent requires, "[...] empathy, communication, and creativity [...]" he

believes are vital to the job of teaching (Pani, 2019, p. 4). So, although it acts as one of the more ambitious and large-scale steps into automated education, it in no way acts as a replacement to classroom teaching.

Outschool

If Khan Academy is too impersonal to meet the needs of students requiring a teacher, perhaps Outschool is the answer. The San Francisco based company uses a similar model of decentralized, digital education to Khan Academy. However, instead of pre-recorded classes, the platform does them live via video chat. Outschool's mission is to, "[...] build real human connection to foster a love of learning". It does so by allowing independent teachers to sign onto the site and create classes, inviting students to apply and take them (Anderson, 2019). And the classes are fun. Instructors tend to match individual classes to both a skill and a guided activity with catchy names to appeal to their audience. Harry Potter Chemistry and a Spanish Sing-Along with Taylor Swift music name just a few (Anderson, 2019). Based on self-reported surveys from the site, 80% of students take the courses just because they want to learn something new, with 20% using it to supplement current course work. This is especially intriguing considering 80% of the students who use the service report that they are home schooled. Class sizes typically range from ten to fifteen students (Anderson, 2019). Outschool also has the backing of major donors, namely Reach Capital and Union Square Ventures, both key backers for Etsy and Twitter. Classes are all about ninety-minutes in length, but most students end up taking many. As one family reported, after trying the site just once, they took about forty classes within two weeks (Anderson, 2019).

However, Outschool is not without its drawbacks, not the least of which has to do with its cost. As opposed to Khan Academy, Outschool is a for-profit company and charges fifteen to eighteen dollars per class, per student (Anderson, 2019). This is likely a product of its educational model. To say that Outschool is an "automated" education tool would likely be inaccurate. It is instead a digital education platform, one which requires individual human work for each class it offers. The platform would also not likely be categorized under the term, "personalized learning". Classes are planned before the instructor usually knows who their students are and how many they'll have in class, with little room for adaptation given it is a single ninety-minute period. Outschool does provide certain benefits not usually offered with other digital platforms, including its more personal use of direct instruction. However, in terms of both its cost and requirement for labor, it certainly does not address the growing need for more tools at an educator's disposal.

Discipline (PredPol and COMPAS)

Although school discipline has been a large policy focus of legislatures for years, not much research has been undertaken as to the potential of automation in school discipline. And this makes sense considering the failures of Zero Tolerance Policies coupled with our reluctance to abandon them. A large meta-analysis of public schools in Texas just recently unveiled that additional funding allocated to school discipline policies correlated in not only increased punishment, but decreased college acceptance rates (Weisburst, 2019). So with those results, it's no wonder that although policymakers are reluctant to give up Zero Tolerance, they could be equally reluctant to allocate more resources to the area of school discipline. However, this does

not mean that the entire concept has been totally abandoned. Indeed, on a list of potential implications for automation in schooling, one educator listed, "[...] discipline, attendance, and grades [...]" as three areas where automation could serve to expedite those processes (Jennings, 2015, p. 3). So this section will explore our future potential in automating this field, with specific examples provided by automation within our own justice system. Since Zero Tolerance Policies were built on the same foundations of deterrence strategies found within the US Justice System, I felt it fitting to pull those examples to see what more, "expedient" school discipline looked like.

For the most part, automation in justice has served to attempt the impossible: predict the future. And the most recent and pervasive tool to do this has seen some success. PredPol, a private company offering purchasable tools and packages to police departments, boasts that it can help improve crime detection by 10-15%. PredPol works by collecting in large amounts of data about the history of crime in that city, including its location, type, and severity. Then, it combines this data with demographic characteristics associated with that area before plugging all information into an algorithm for determination (Smith, 2018). Predpol will then give Police Departments a 500-foot radius to patrol where the algorithm predicts a crime will happen within the following twelve hours. For areas with more constant predictions, Police Departments also usually set up surveillance cameras. In total, PredPol is currently known to be active in at least fifteen major cities in the United States, with the disclosure of private documents being how we know (Haskins, 2019). If schools were to use a system like PredPol, it likely would not be too dissimilar from our current systems of, "tracking" students who misbehave. However, the key difference would likely be the extent of the tracking. Now, students or areas determined to be "high risk" would be monitored nearly around the clock at school.

Another high-tech area of police prediction deals specifically with sentencing procedures. COMPAS, or Correctional Offender Management Profiling for Alternative Sanctions, is a predictive tool used to determine if someone should be offered bail or held until trial. The main prediction at hand therefore deals with whether or not they are a threat to society and will commit another crime (Turner-Lee, Resnick, & Barton, 2019). While it is difficult to put an exact number to the amount of courtrooms that use COMPAS, it is used in nearly every state (Angwin, Larson, Kirchner, & Mattu, 2019). Within only a few years of operation, it determined tens of thousands of people should be held and denied bail. And it did this using a similar strategy to PredPol. After collecting the demographic data of that particular defendant and then general crime data for the area, and putting that data through an algorithm, it gave the judge a recommendation (Angwin, Larson, Kirchner, & Mattu, 2019). This particular tool mostly serves as a judgement call, a job usually given to an individual judge that is replaced by a computer system. The goal, then, is to eliminate individual bias in decision making. In schooling, this would likely be used in a number of ways, whether it be determining if a suspended student should return to school, if a student should be expelled, or just how severe a punishment would need to be to act as an effective deterrent. Whatever the application, this tool would mostly take the job of deciding punishments out of the hands of individuals and put them firmly in the hands of automation.

Applications in Development (Google, Hobsons, and GiantOtter)

For more generalized platforms like the office tools for Google, although the current operation is more of a supplemental tool, it could easily move into a conversation of

replacement. The sharing capabilities of projects within a Google Drive both provides a data platform and vehicle for decentralized education, affording the ability of teachers around the country to more fully automate their educational practices (Kamenetz, Feinberg, & Mason, 2018). The company has also developed, "Google Duplex" a program which can easily turn a command into an eerily human-sounding conversation. Now operating on Pixel phones, it's currently most often used for small tasks like making dinner reservations. Users can say, "make me a reservation for 7 at this location" and the system will make a call on their behalf, have a short conversation with a restaurant host, and send them an email receipt of the interaction (Kim, 2018, p. 3). But combined with a system like Watson, it could easily take the role of automated TA much farther to a much more "personalized" instructor.

Other technologies and ideas can easily be adapted from other fields to fit educational needs. Predictive analytics tools popularized through business and government fields cover a few of them. Hobsons is a company that sells consulting software and has been moving into higher education to track student progress. However, it is most often used to fit students' non-academic needs. Hobsons Senior Vice President Howard Bell explains:

> We took the gut reaction of the advisor out of the equation. [...] Now we actually analyze and say which demographic of students is performing at or below what we consider the norm —then you figure out where they're having trouble (Schrager & Wang, 2017, p. 4).

For example, at one university, the software was able to predict twenty-six students likely to drop out based upon the hundreds of encoded variables it can access. The next day, the president of the university was able to examine all of the student's profiles and take action to try to best ensure they get the support they need (Schrager & Wang, 2017). Another tool is "GiantOtter", the product of an MIT Media Lab start-up creating an A.I. coach for business managers. The tech can help answer questions regarding leadership, standard business practices, and even intrapersonal conflict. With a different database to pull from, it could feasibly assist overburdened counselors or advisers (Meister, 2016). The technology used to automate practices within education seem to just be starting. And as these technologies advance, they will continue to set a new precedent for how much, or little, must be done manually in educational spaces.

DISCUSSION

"Personalized Learning" does not necessarily entail that students are catered to in the process designing a curriculum. Rather, it means that students get a greater degree of choice in how they learn (Kamenetz, Feinberg, & Mason, 2018). But for platforms like Summit Learning, Khan Academy, and Outschool, it is difficult to imagine the automated content being tailored to a particular student. Most of these are preset and universal, ensuring every student sees basically the same set of content. Khan Academy and Outschool do offer a greater degree of personal choice to the student relative to a platform like Summit Learning, giving students the ability to decide their curriculum rather than being handed one. For Summit Learning, this showed clearly, with nearly the same exact curriculum cut and pasted for nearly 400 public schools (Strauss, 2018). The demographics of those public schools, their students' histories, and a host of other personal information was collected by Facebook, but they did not necessarily allow it to largely influence their curriculum (Strauss, 2018). That's also likely why Outschool and Khan Academy have higher opinions amongst their students. The lessons provided on these platforms are up to the choice of a student, but not always in a standard classroom. For example, when Khan Academy is used in classrooms, the teacher usually decides what material to pull from it (Johnson, 2018). However, this still provides a greater degree of personalization than if that decision were automated too.

Likewise, when these platforms use the term, "personalized" what they really mean is "personalized pace". What all three platforms offer is flexibility as to the speed that students go through content, allowing them to accelerate or slow down as they choose. In many ways, this becomes an illusion of personalization. A student who has a genuine desire to be represented in

their curriculum, to see examples that appeal to them, and to have their identity given active value will likely not be able to easily find it on these platforms. Most still cater to helping students through school, which means they embrace similar problems to many school standards (Kamenetz, Feinberg, & Mason, 2018). The curriculums tell stories of the dominant narrative and they do not challenge students to think more critically about the stories told. Rather, they behave in a manner that embodies social reproduction, rewarding students for memorizing and repeating information rather than embracing higher order thinking. So for issues involving an automated curriculum, the responsibilities of an instructor cannot be matched. From Funds of Knowledge, to the Whole Student Approach, to Culturally Relevant Pedagogy, and to Representation, student's needs are not being met by these platforms. So for curriculum design, Sal Khan was correct: it takes a teacher actively engaging with their students to build a proper curriculum (Pani, 2019).

Democratic classrooms present ambitious goals for students and educators that can be difficult to automate given our current capabilities. As seen in the two previous sections, there is a stark contrast between the goals presented under, “Democratic Classrooms” and “Personalized Learning”. Democratic classrooms balance treating students as active individuals and participants within a collective class, while Personalized Learning merely aims to more individualized education (Rubin, El-Haj, Graham, & Clay, 2016; Kamenetz, Feinberg, & Mason, 2018). But forgoing collective action has its costs. After all, when students of Summit Learning across the country were denied the right to dictate their own education and use their voices effectively in the classroom, they took to the streets to use their voices outside class (Strauss, 2018). It also showcased how truly undemocratic these systems can be. Personalized Learning

becomes a bit of a misnomer when students do not actually feel they have a voice in their education. The systems did not learn or change based upon their concerns, they simply slowed down, allowing students only a degree of choice involving, “pacing”, but not necessarily anything else (Kamenetz, Feinberg, & Mason, 2018, p. 2). Even Watson had their limits, as the system could only really answer student questions, and having to forward anything more complex to a human instructor. If a student had a critique of the course or genuine challenge totally unique to them, Watson would not be able to assist them (McFarland, 2016). These shortfalls ensure an automated, democratic classroom is far from our current capabilities.

Moreover, these automated systems may serve to reinforce a student deficit thinking model (Valencia, 1997). Summit Learning provides opportunities to students and teachers, but with the cost of certain freedoms lost with a human teacher or TA. The program treated students as passive agents in the process of their own learning (Kamenetz, Feinberg, & Mason, 2018). Other than affording "pacing" as the only opportunity to directly influence or alter their curriculum, it also assumed a student’s ideas could be of no value to their learning. Discussions, group projects, and essay questions are not core parts of the curriculum, so student's opinions never get opened up to the room (Strauss, 2018). Instead, they are confined to, “Personalized Learning” in front of a computer screen. This ensures conversations of structural inequality never get brought up and if they do, they certainly are not personally related to the students. And this can reinforce the deficit thinking model or the belief that, “[...] the student who fails in school does so because of internal deficits or deficiencies” (Valenzuela, 1999, p. 2). But this theory is also grounded in classism and racism, as it has historically targeted those on the margins of society who underperform in the normative white curriculum (Valenzuela, 1999). Summit

Learning does not teach complex versions of history and their moral implications, it just reintroduces textbook content (Strauss, 2018). In this way, it gives marginalized students a program that was not designed for them and blames them for not enjoying it. Because for Summit Learning, there are only two kinds of students: fast and slow.

The Watson/IBM partnership might produce the closest automated system to a democratic education. Befitting Abowitz and Harnish's (2006) argument concerning the need for social studies teachers to challenge their student's answers and perspectives, the "Digital Tutor" imagined by the two corporations might be able to fulfill that burden (Schrager & Wang, 2017). The system could theoretically take a student question, answer it, and then give a follow-up question concerning their opinion of the answer. If the system were encoded with justice-oriented information, it could theoretically ask moralistic questions as well, challenging a student's perspective on a given issue (Schrager & Wang, 2017). However, even then, this still could not come close to taking the job of a teacher. The Watson/IBM partnership would still very much produce an interface similar to a chatbot, engaging in a conversation with a student regarding the content they initially asked about, but not taking the conversation further to talk about the students themselves (McFarland, 2016). The student's identity, personality, and personhood would therefore not be given attention in the educational space. In La Escuela Fratney, a middle school in Milwaukee, how students thought about themselves became so vital, they brought in a self-esteem specialist full time (Apple & Beane, 1995). It is this kind of intervention that we are far from realistically automating. Even technologies like Hobsons and GiantOtter can give advice, but without distinguishing individual users and their individual personalities (Meister, 2016). So although the textbook maker and tech giant come the closest to

fully automating a democratic experience, we are still a long way from digitizing the democratic ideal.

However, it is also worth mentioning that these systems were not intended to uphold democratic ideals. For both Summit Learning and Watson, the goal was not necessarily to produce democratic teachers, but to provide equity to a space where it was previously lacking. Most schools where Summit was implemented did so due to a shortage of teachers proficient in the areas they needed and for Watson, it was a struggling cohort of TA's (Leskin, 2018; McFarland, 2016). As Dr. Goel, designer of the Watson TA explains:

> There are seven billion people on this earth and about half of them don't have access to good education. If we can take artificial intelligence and provide those people with minimal question-answering, who knows what a difference it could make in someone's life (Schrager & Wang, 2017, p. 5).

Automation systems, which can take the knowledge base of some of our best minds and disperse them across the globe at a low cost, could make a big difference in getting closer to education equity (Houser, 2018). They in no way act as replacements to teachers, but right now can act as amazingly supportive supplemental tools to get us closer to that ideal (Bidshahri, 2017). Democratic classrooms provide incredible opportunities to the students they encompass and require a skilled teacher to properly foster them (Abowitz & Harnish, 2006). But for those who would consider themselves fortunate to get any kind of education, automation could still be the answer.

And for discipline, although both PredPol and COMPAS aim to eliminate it in decision making, the vulnerability of the systems is clear: bias. COMPAS was found in 2013 to disproportionately target African Americans in making more punitive decisions, denying them the opportunity to be released on bail significantly more than their white counterparts (Smith, 2018). And PredPol has similar problems, as its application has usually only resulted in large scale surveillance campaigns on communities of color (Angwin, Larson, Kirchner, & Mattu, 2019). In both cases the issue became a misinterpretation of the input data. The inputs were from historical data, showcasing the broad story of crime across a city. Sometimes, this crime spanned decades, going far before we even had computerized systems as this data was input retroactively. However, what the systems did not consider is that historically, we have had an incredibly bias police state. African Americans showed up as more likely criminals mostly because the police were most interested in targeting them. The War on Drugs meant that although many of these might have been small offenses too, the system categorized them as felonies. PredPol and COMPAS both made grand assumptions about who is and is not a criminal, resulting in a system design somehow more racist than even our current justice system.

And, if implemented in education, the results would likely be the same. Our current disciplinary system already overwhelmingly targets Black and Latinx students, mostly through implicit bias. It started with our social understanding of race, as Heitzeg (2009) states:

> Blacks are mostly likely to be seen on TV news as criminals; they are four times more likely than whites to be seen in a mug shot; twice as likely to be shown in physical restraints; and 2 times less likely to be identified by name (p. 3).

And from there, it begins to take on a reflection within our schooling system. A large-scale study of Texas Public Schools revealed that, out of all the thousands of students surveyed, 83% of Black students, 74% of Hispanic students, and only 59% of white students had at one point been punished in school. Overall, it found that African American students were 31% more likely to get punished in school than their white counterparts (Fabelo et. al, 2011). And for programs like PredPol and COMPAS, they would interpret these facts as mere products of a perfect disciplinary system. They would ignore the possibility of discrimination and therefore continue on the same bias reflected in the facts they were handed. In essence, if we were to automate our current disciplinary system, all we would likely see is a continuation and advancement of discrimination is the way we target students. In fulfilling a goal of a more Restorative disciplinary policy, automation is therefore far from the answer.

FUTURE RESEARCH IMPLICATIONS

With a field still early in its development, automating education still has far to go and much more to research. The most pertinent area of research focused on here will be machine learning technologies applied to education. IBM's Watson technically operates a tool called, "machine learning" (Although Dr. Goel did not have access to this sophistication with Jill Watson) wherein the computer stores knowledge based on its own decisions and observations. This means that over time, the system becomes smarter without constant human inputs, especially when dealing with the same question or command it already experienced (Meserole, 2018). For example, after Watson read thousands of medical journals in a matter of minutes, it was able to not only give a diagnosis but learn from its own mistakes in prior diagnosis (Galeon, 2016). Applied to classrooms, this means a machine learning artificial intelligence could allow an automated system to actually get to know and understand students over time. Allowing machines to actually and critically engage with students would drastically improve its potential to operate as an instructor. Moreover, if the computers were interconnected and the knowledge was centrally stored, it would likely build the largest suppository of educational data created. And given the immense storage size, absolute memory, and carefully tested skills of a machine learning computer, it would undoubtedly eventually surpass the understanding of any human teacher about the practice of teaching.

Additionally, even if just used and expanded it as a supplemental tool, the effect of automation could revolutionize education. In the United States, enrollment in teacher preparation programs has dropped thirty-five percent, a decrease of nearly 240,000 teachers (Westervelt, 2016). Additionally, eight-percent of teachers leave the field every year, but less than a third are

leaving for retirement. That means over 200,000 teachers each year are choosing to pursue a different career (Westervelt, 2016). And it is not just a US problem. In the UK for example, it is slightly higher at nine-percent of the workforce (Tapper, 2018). And for most of these teachers, the term usually used to describe their exit of the field is this: burnout. Burnout has to do with a culmination of stress and anxiety associated with the high standards of performance teachers are under. A teacher's job goes above and beyond the job specifications and the hours outlined in their contract. And, without the help or resources to manage that, it is no wonder that many teachers are choosing to leave the field prematurely (Westervelt, 2016). However, that is exactly where automation can come in and help. Maybe not all aspects of a teacher's job can be automated, but certainly more of them could be. And with organizations like Khan Academy already paving the way to do so through programs like Teacher Aid, we are making great strides in automating larger aspects of a teacher's job. In many professions, automation is viewed as a cataclysmic inevitability. But for teachers, it might just be what makes their profession livable.

However, while the potential benefits of machine learning in education are revolutionary, the drawbacks are somewhat dystopian. Machine Learning implies the computer developing knowledge, but not necessarily the same way we do. It cannot distinguish between valuable and useless information, meaning it stores, retains and eventually recycles everything it experiences (Meserole, 2018). And this can get into trouble when you consider our collective societies are its teachers. For example, when Microsoft introduced a Machine Learning Chatbot to Twitter in 2016, it got taken over. "Tay", as the system was called, would alter their tweets based upon what people tweeted at them. So after the Alt-Right began a coordinated trolling campaign, Tay was giving racist and anti-semitic comments within only sixteen hours, forcing Microsoft to shut

it down (Stuart-Ulin, 2018). With a dataset that big, curating data can be near to impossible, requiring hundreds of human hours to correct an automated mistake (Cheng, 2018). And it would not take the Alt-Right to make a system racist. As shown through PredPol and COMPAS, even our own data has been tainted with systemic racism such to the extent that giving the system viable data and an awareness of racial bias is a difficult technological problem we are hardly ready to tackle. Additionally, such a system would also stoke the same privacy concerns as "Summit Learning". The dataset would learn something from an interaction one minute and use it the next, clearly showcasing to students and parents any interaction they have with the interface is indefinitely stored (Meserole, 2018). Likewise, given the frequent stringency of public-school administrators and their access to stored data, it would likely feel much more like surveillance than learning. Overall, machine learning still has a way to go before being adopted in a school but offers a real glimpse into a world where automation takes a significantly more dominant role in the classroom.

CONCLUSION

Father of contemporary computing Alan Turing developed what was called the "Turing Test" in 1950. The test assesses a machines ability to showcase personal traits so lifelike, the interface becomes indistinguishable from human intelligence (Hern, 2014). And as Jennifer Gavin, a student in the Dr. Goel's Spring 2016 class explains, "[Talking to Jill Watson] seemed very much like a normal conversation with a human being" (Schrager & Wang, 2017, p. 6). But perhaps a greater challenge than convincing a class a computer is a human is convincing them it is a good teacher. This paper explored how well our current technological capabilities can build an automated education by creating a definitional framework, applying it to case studies, discussing the results, and examining future implications. Ultimately, it found we are still a long way from perfecting this technology but have made huge strides in developing highly effective teacher supplemental tools. The job of a teacher does not just entail expertise, but complex social interactions which change and develop with every new student encountered. As author and scholar Bill Ayers (2010) explains, "Teaching at it best is not a matter of technique, it's primarily an act of love" (p. 11). For the students at the Secondary School for Journalism in New York City, it is that love that is still absent in their education.

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